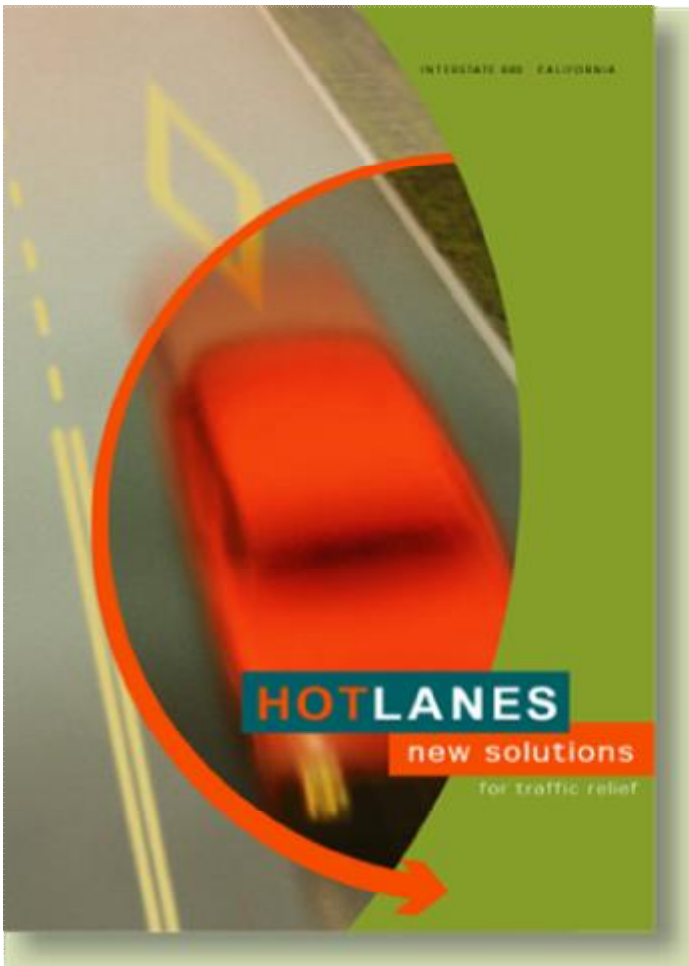

Southbound I-680 Smart Carpool Lane Enforcement Plan

Submitted to:

Alameda County
Congestion Management
Agency

Submitted by the
Partnership Team of:

ENGINEERS
PLANNERS
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I-680 Smart Carpool Lane Enforcement

Enforcement Group
Proper enforcement of the I-680 Smart Carpool Lane program is essential to its success. Recognizing the importance of system enforcement, the Alameda County Congestion Management Agency (ACCMA) established a working group to analyze, establish and implement a system enforcement plan. This group is composed of representatives from ACCMA, the California Highway Patrol (CHP) and the consultants from the Smart Lane Program Team.

Current HOV Lane System
A High Occupancy Vehicle (HOV) lane, which is referred to as a carpool lane, has been established on I-680 running southbound from just south of the State Route (SR) 84 Interchange near Pleasanton to just south of Calaveras Boulevard (SR 237) in Milpitas.

The HOV lane is currently restricted to vehicles with two or more occupants, buses and motorcycles during the morning peak period. It is available to everyone the remainder of the day. Access to the HOV lane is not restricted (i.e. permitted vehicles can enter and exit the HOV lane continuously).

Current HOV Lane Enforcement
The enforcement goal with the current HOV lane system is to maintain free flowing lanes for HOVs during all restricted hours. Given the unlimited access to the carpool lanes, enforcing these lanes can prove to be challenging. CHP enforcement officers are limited to visual observation of violating vehicles. Video enforcement of the HOV lane is not currently used.

I-680 Smart Carpool Lane System
The I-680 Smart Carpool Lane System will allow Single Occupant Vehicles (SOV) to use the carpool lane by paying a toll. The carpool lane, therefore, will become a High Occupancy Toll (HOT) lane and it is anticipated that it will be restricted to carpools (vehicles with 2 or more people), buses, motorcycles, other eligible HOV vehicles and SOV operators that choose to pay a toll to utilize the additional capacity in the HOV lane. The I-680 Smart Lane will operate on a 24 hours a day, seven days per week basis. All HOVs, buses and motorcycles may continue to use the lane without charge and without having a transponder.

SOV drivers choosing to use the Smart Lane will need to be members of the FasTrak electronic toll collection (ETC) system, equip their vehicle with a transponder and have an account that is in good standing. The transponder will be placed either on the windshield or on the front license plate of their vehicle and radio frequency (RF) technology will be utilized to identify the vehicle's transponder as it travels in the Smart Lane through each of the tolling zones.

Toll rates for SOVs that choose to utilize the Smart Lane will be determined dynamically by using traffic density and speed information from the Smart Lane and travel time data

from the mixed-flow (MF) lanes. As the traffic density (TD) in the Smart Lane increases or decreases, the rates will go up or down respectively. Even though the toll rates will dynamically change based upon the TD that is detected and continuously reported from the Smart Lane and travel time data that is collected from the MF lanes, minimum and maximum toll rates will also be instituted.

The goal of the I-680 Smart Lane system is to allow SOVs to use the lane without reducing the current quality of trips in the HOV lane. The target TD will be to maintain traffic at level of service "C" or better, which will maintain vehicle speeds of approximately 50 miles per hour (MPH). Toll rates will be used to manage the number of SOVs that are allowed to utilize the Smart lane by adjusting the toll rates dynamically.

Smart Carpool Lane System Enforcement

In order to manage the traffic in the Smart Lane using dynamic pricing, careful and efficient system enforcement is essential. Uncontrolled use of the Smart Lane by unauthorized vehicles will cause overcrowding, disrupt the dynamic pricing process and jeopardize the success of the pilot project.

The I-680 enforcement process will always include some type of visual monitoring to determine how many occupants are in the vehicles that are traveling in the Smart Lane. Visual enforcement is performed by observing driver behavior entering and exiting the Smart Lane and determining if a transponder is visible on the windshield. Access to the Smart Lane will be controlled through the use of triple painted lines (one white line and double yellow lines). Primary emphasis for enforcement will be reducing or attempting to eliminate the number of SOVs that use the Smart Lane without a valid transponder and minimizing occurrences of vehicles crossing the double white lines. However, it is presumed that all other typical traffic violations will also be enforced by the CHP in the southbound I-680 Smart Lane corridor, including speeding, seat belt violations, etc.

The I-680 Smart Lane that will need to be enforced is shown in Figures 1 and 2. Figure 1 shows the northern segment of the Smart Lane between Route 84 and Grimmer Boulevard and Figure 2 shows the southern segment of the lane that extends from Grimmer Boulevard to Route 237 in the south.

Enforcement areas will be implemented to assist CHP officers in the I-680 Smart Lane enforcement process. As shown in Figures 1 and 2, a minimum of two 400-meter long by 4.8 meters wide enforcement zones will be deployed between approximate Stations 75+00 and 96+40 and between 24+00 and 58+40. Two other enforcement locations, one north of the Jacklin interchange and one north of the Mission 262 interchange, will provide 4.9 meter wide inside shoulders that will be approximately 400 meters in length. These inside shoulder areas are available to CHP officers to conduct important enforcement of the Smart Lane.

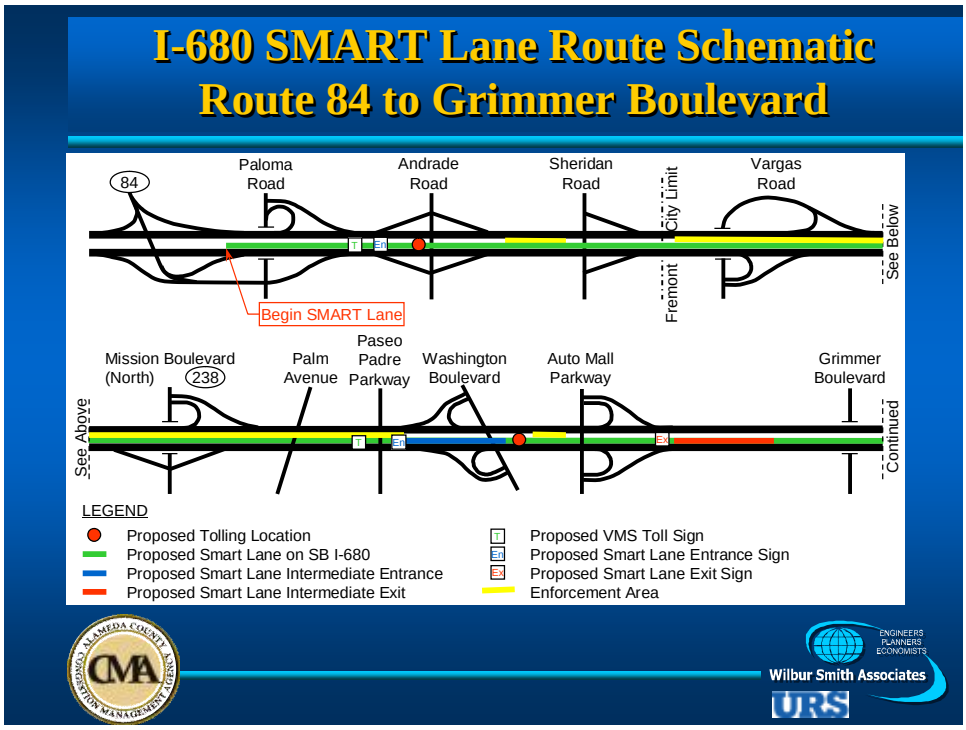

Figure 1 – I-680 Smart Lane Northern Segment

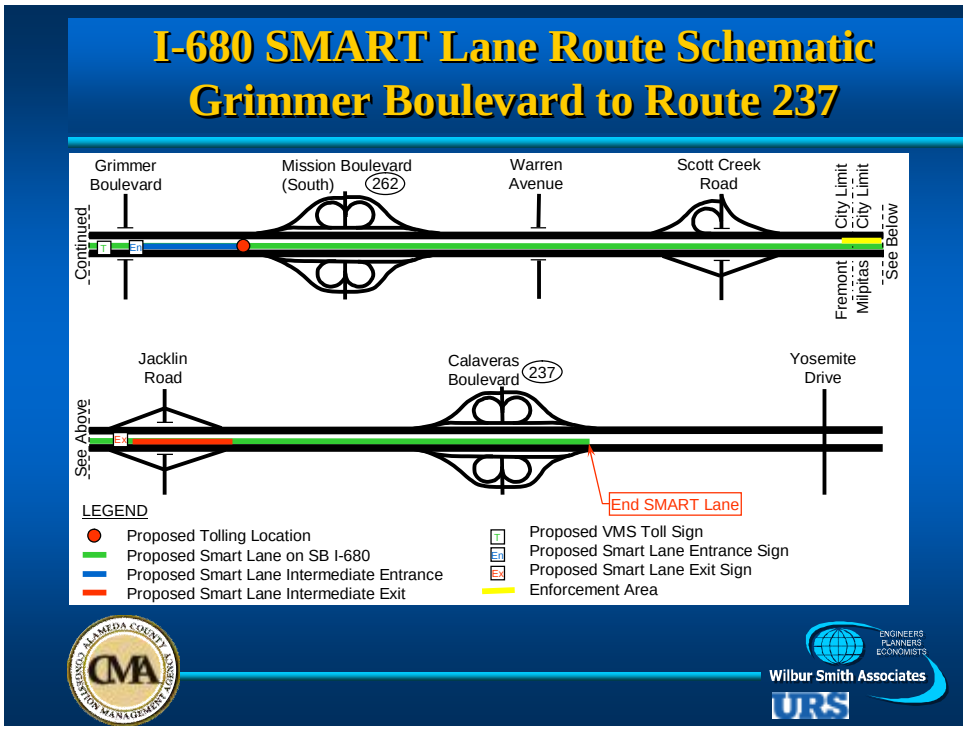

Figure 2 – I-680 Smart Lane Southern Segment

Smart Carpool Lane System Enforcement Tools

The CHP will provide enforcement and will make use of three important enforcement tools, which will be provided to them and be maintained by the Joint Powers Agency (JPA).

- Transponder Detection Beacons;
- Hand Held Enforcement Units; and
- Mobile Enforcement Readers (MERs).

Transponder Detection Beacons - Enforcement beacons are flashing lights that would be located facing upstream at each tolling zone. The beacons will indicate that a vehicle passing through the tolling zone is equipped with a valid transponder, which would be located either on its windshield or on the front license plate. If the light does not illuminate, a CHP officer would then visually determine how many people are in the vehicle and pull over any single occupant vehicles to issue the driver a citation for improperly using the Smart Lane. Non-CHP officers would be encouraged to report violators to the Customer Service Center. Presented below as Figure 3 is a picture of a typical enforcement beacon that is mounted within the Smart Lane tolling zone area.

Figure 3 – Transponder Detection Beacon

Hand Held Enforcement Units – CHP officers that are conducting Smart Lane enforcement in vehicles that are not equipped with a Mobile Enforcement Reader (MER), including motorcycles, will be provided with a wireless hand held enforcement unit. The CHP officers will utilize the hand held units in conjunction with the tolling zone beacons in order to effectively enforce Smart Lane compliance. This unit will be designed to be able to read the account number from FasTrak transponders. Once the transponder number is read, the software program that is resident on the hand held unit will determine what account the transponder number is associated. Once it is determined what the FasTrak account number is, it will be compared to the tag status file to determine whether or not the account is in good standing. New versions of the tag status file will be automatically downloaded from the Toll Data Center (TDC) to the hand held device each

day at approximately 3:00 a.m. It is envisioned that an incremental file will be transmitted each day to the hand held device, not the entire valid FasTrak account list. This information will allow the CHP officer to issue a violation citation to the vehicle operator if the transponder is linked to an invalid account and there is only one person in the vehicle.

(1) Mobile Enforcement Readers - The All costs are in 2006 dollars.
MER is a device that is installed on enforcement vehicles that allow an officer to either park anywhere on the shoulder of the road and detect the transponders that pass their vehicle or to travel adjacent to a vehicle in the Smart Lane and query whether the passing vehicles are equipped with a valid transponder. A MER would permit Smart Lane enforcement activities by CHP officers while traveling at highway speeds.

The MER will be mounted on the patrol vehicles and consist of a FasTrak ETC reader, control/display unit and an antenna. As of this writing, the only location in which MER antennas have been installed is on the left-side of the emergency light bar. However, investigation will be conducted to determine whether or not it is technically feasible to mount the antenna inside of the patrol vehicles. The ETC reader and antenna units will be FasTrak compliant devices which operate at 915 MHz frequency, or whichever Title-21 ETC standard is currently in place coincident with commissioning of the Smart Lane system.

The onboard control/display unit will be designed to be used while safely driving the patrol car and is typically mounted in the front seat within easy reach of the officer. A directional antenna will be mounted on the roof, or back trunk lid, of the patrol vehicle, pointing towards the left side of the vehicle. This would allow the MER to detect whether a vehicle driving alongside the enforcement vehicle is equipped with a FasTrak transponder. The MER software will then compare the just identified transponder number to the tag status file list that is resident in the reader to confirm whether or not the transponder is in good standing. The FasTrak tag status file data will be automatically downloaded from the TDC to the reader at approximately 3:00 each morning.

Figure 4 depicts a typical scenario in which a CHP officer whose vehicle is equipped with a MER is checking to see whether the vehicle traveling in the Smart Lane is equipped with a FasTrak transponder that is in good standing.

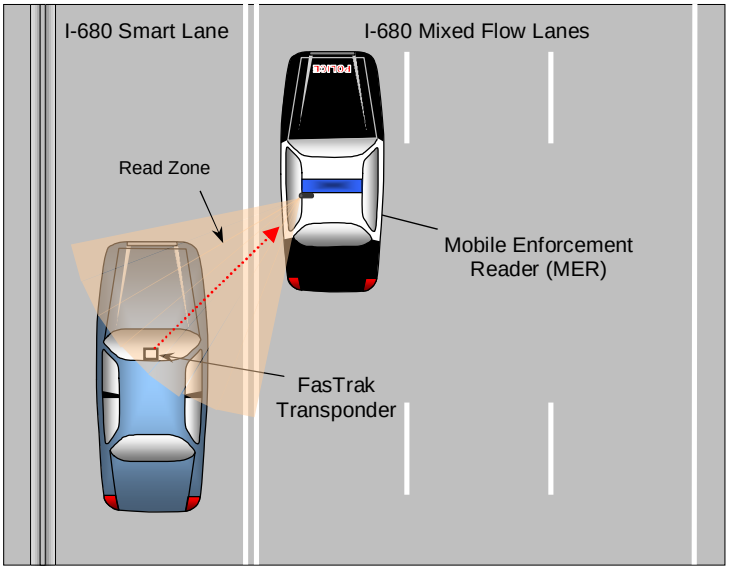

Figure 4 – Mobile Enforcement Reader Diagram

Presented below in Figure 5 is a picture of a typical MER antenna that is mounted on the emergency light rack of an enforcement vehicle.

Figure 5 – Mobile Enforcement Reader Antenna

The transponder read will provide the CHP officer with the transponder number which will then be checked against the tag status file, which will be resident in the reader software, to determine whether the account that is linked to the transponder is in good standing (i.e. valid, not valid). If the information confirms that the SOV is not properly using the Smart Lane, the CHP officer can assume that the vehicle operator is a violator.

Presented below as Figure 6 is a picture of a typical on-board control/display unit, in this case a Personal Digital Assistant (PDA) device, which allows the CHP officer to initiate a transponder query read within the antenna RF scanning area. The query request can be

initiated by physically touching the PDA screen, which allows the CHP officer to continue to look forward, thus creating a safe operating environment.

Figure 6 – On-Board Mobile Enforcement Reader Unit

Figure 7, which is presented below, provides a very preliminary schedule of the expected I-680 Smart Lane enforcement coverage. The actual hours that will be used for Smart Lane enforcement will be adjusted through discussions between the JPA, the system operator, and the CHP Supervisor. The following table will produce approximately 8-9 passes along the southbound Smart Lane during the peak periods with random enforcement during the off-peak periods.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday/ Holiday	Sunday/ Holiday	Total
5:00 AM								
6:00 AM	**2CHP**	**2CHP**	**2CHP**	**2CHP**	**2CHP**			
7:00 AM	**2CHP**	**2CHP**	**2CHP**	**2CHP**	**2CHP**			
8:00 AM	**2CHP**	**2CHP**	**2CHP**	**2CHP**	**2CHP**			
9:00 AM	**2CHP**	**2CHP**	**2CHP**	**2CHP**	**2CHP**			
10:00 AM	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**			
11:00 AM						**CHP**	**CHP**	
12:00 PM						**CHP**	**CHP**	
1:00 PM						**CHP**	**CHP**	
2:00 PM								
3:00 PM								
4:00 PM	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	
5:00 PM	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	
6:00 PM	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	**CHP**	
7:00 PM								
8:00 PM								

9:00 PM								
10:00 PM								
11:00 PM								
Daily Hours	**12**	**12**	**12**	**12**	**12**	**6**	**6**	
Annual Total	**624**	**624**	**624**	**624**	**624**	**312**	**312**	**3,744**

Figure 7 – Smart Lane Enforcement Hours

During the first 3 to 5 weeks of Smart Lane operations, an additional 8 to 10 hours per day of enforcement may be needed to establish an enforcement presence.

Enforcement Training Plan
Training of the CHP enforcement officers will take place during a half day session. Training will cover the use of the Transponder detection beacons, the MERs and the hand held enforcement devices. Training will be provided for hands-on use of the equipment in showing how the enforcement equipment operates while on-site, driving at highway speeds, etc.

Locations: TBD

Maximum Participants: 5

Required Equipment: Vehicles from CHP that are equipped with MER units

Curriculum and Agenda
Enforcement training would involve, as a minimum, the following courses:

Enforcement Background Training 1.0 hour
- The operation of the Smart Lane tolling system
- What is a transponder and how does it operate
- Introduction to the FasTrak tag status list and how the enforcement tools will identify the validity check of Smart Lane transponders
- Introduction to the Smart Lane system enforcement tools

Enforcement Beacon Training 0.5 hour
- Description of the enforcement beacon features and use
- Demonstration of the enforcement beacons

Mobile Enforcement Reader Training 1 hour
- Description of the MER features and use
- Utilization of the on-vehicle device (PDA) and the FasTrak tag status file
- Demonstration of the MER
- Hands-on use of the MER

Hand Held Enforcement Unit Training 1 hour

- Description of the Hand Held Unit features and use
- Utilization of the Unit regarding the FasTrak tag status file
- Demonstration of the Hand Held Unit
- Hands-on use of the Hand Held Unit

I-680 Smart Lane System Enforcement Estimated Capital Costs

The estimated project capital costs for the I-680 Smart Lane system enforcement would be as follows:

Item	Quantity	Unit	Unit Cost (1)	Total Cost (1)
Mobile Enforcement Readers	5	Each	$30,000	$150,000
Transponder Beacons	3	Each	$5,000	$15,000
Beacon Software	1	Each	$50,000	$50,000
Hand Held Devices	5	Each	$25,000	$125,000
Training Costs	30	Hours	$80.00	$2,400
TOTAL				$342,400

(1) All costs are in 2006 dollars.

I-680 Smart Lane System Enforcement Operating Budget

The annual operating budget for I-680 Smart Lane system enforcement is estimated to be as follows:

Item	Quantity	Unit	Unit Cost (2)	Total Cost (2)
California Highway Patrol (1)	3,744	Hours	$80.00	$299,520
Vehicle/Equipment Maintenance	1	Each	$30,000	$30,000
Initial added Enforcement	50	Hours	$80.00	$4,000
On-going Training Costs	30	Hours	$80.00	$2,400
TOTAL				$335,920

(1) Estimate includes the CHP enforcement coverage that is presented in Figure 7.
(2) All costs are in 2006 dollars.

System Enforcement Reporting

Reports will be developed from CHP officer enforcement logs indicating various information pertaining to the I-680 Smart Lane enforcement effort, including, as a minimum:

- The total number of hours of enforcement;

- At which specific locations was enforcement applied;
- How many Smart Lane violation citations were issued;
- How many warnings were issued;
- How many citations were issued to vehicle operators that crossed the double lines; and more.

The Smart Lane system enforcement reports will be included with reports from the electronic toll collection (ETS) system indicating transponder usage during the same time periods and estimated HOV usage. This will allow the JPA and CHP to properly judge how well the Smart Lane enforcement process is working. An example of a summary report is depicted below as Exhibit 8:

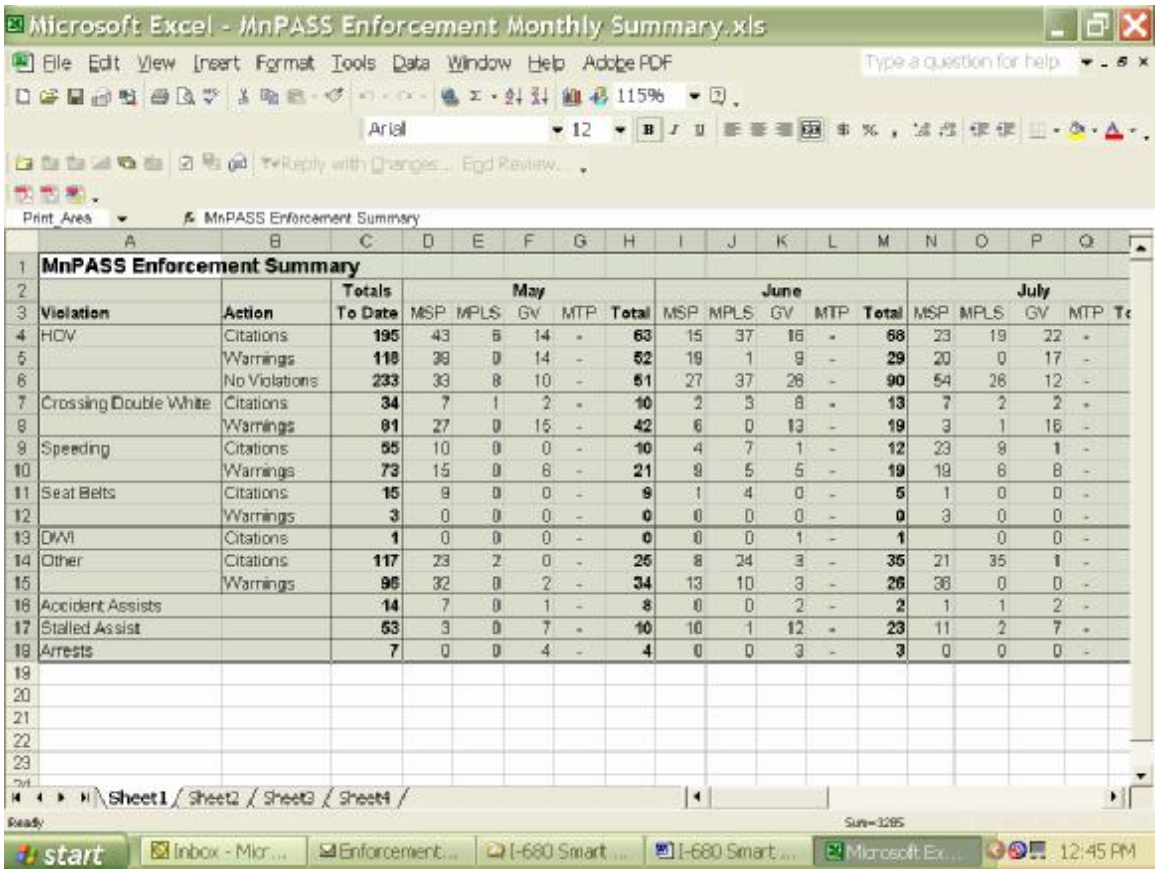

Figure 8 – Enforcement Summary

Conclusion

The enforcement plan outlined in this document maximizes the resources available for this pilot project. Enforcement efforts could be increased by adding more enforcement hours and equipment, if deemed necessary by the JPA. This will be considered after operations begin and a determination is made as to the effectiveness of the enforcement plan that is outlined herein.

The plan will be successful if the level of complaints from those using the Smart Lane properly does not indicate an atmosphere of unfairness and the traffic in the lanes can be properly managed by the dynamic adjustment of tolls.